

AperTO - Archivio Istituzionale Open Access dell'Università di Torino

Single pulse TMS over SMA disrupts both veridical and illusory sense of agency

This is the author's manuscript

Original Citation:

Availability:

This version is available <http://hdl.handle.net/2318/1652917> since 2017-11-24T08:21:38Z

Publisher:

SINP

Terms of use:

Open Access

Anyone can freely access the full text of works made available as "Open Access". Works made available under a Creative Commons license can be used according to the terms and conditions of said license. Use of all other works requires consent of the right holder (author or publisher) if not exempted from copyright protection by the applicable law.

(Article begins on next page)

componente negativa, entrambe posteriori e modulate dall'attenzione, tra le diverse condizioni, sia nel campo cieco che in quello sano. I dati di risonanza, pre-processati mediante Independent Component Analysis (ICA), sono stati sottoposti a General Linear Model (GLM) e ad analisi ROI considerando separatamente le aree visive, svolgendo contrasti tra le condizioni singole e la condizione di riposo. I risultati per stimolazione del campo cieco hanno indicato, per la condizione valida, un'attività occipitale bilaterale con predominanza ipsilaterale e per la condizione invalida un'attività ipsilaterale significativamente ridotta. Le analisi DTI hanno evidenziato una completa interruzione delle radiazioni ottiche di destra e la possibile conservazione di proiezioni dal tronco encefalico alla corteccia visiva.

Discussione

In conclusione, nella paziente F.B. l'attenzione spaziale verso il campo cieco modula sia i tempi di reazione che l'attività occipitale principalmente a livello dell'emisfero ipsilaterale probabilmente tramite connessioni sottocorticali interemisferiche che non coinvolgono le radiazioni ottiche, totalmente assenti nella paziente.

Bibliografia

Kentridge, R. W., Nijboer, T. C. W., & Heywood, C. A. (2008). Attended but unseen: Visual attention is not sufficient for visual awareness. *Neuropsychologia*, 46(3), 864-869.

18. SINGLE PULSE TMS OVER SMA DISRUPTS BOTH VERIDICAL AND ILLUSORY SENSE OF AGENCY

M. Pyasik¹, A. Salatino¹, D. Burin¹, A. Berti¹, R. Ricci^{1,2}, L. Pia^{1,2}

1. SAMBA (*SpAtial, Motor and Bodily Awareness*) Research Group, Department of Psychology, University of Turin, Turin, Italy

2. NIT (*Neuroscience Institute of Turin*) Turin, Italy

Introduction

We previously showed that ownership over a fake hand (i.e., rubber hand illusion) triggers an illusory agency over its movements at both explicit (i.e., misattribution to the own will) and implicit (i.e., attenuation of the somatosensory consequences) levels (Burin, Pyasik, Salatino, & Pia, 2017). Here we examined the neural signature of such pattern by means of single pulse TMS. We predicted that single pulse TMS over supplementary motor area (SMA), known to be related to motor intention and sensory attenuation (SA) (Haggard & Whitford, 2004), would decrease the stimulus intensity of both self- and embodied-hand generated stimuli.

Materials and Methods

Sixteen healthy right-handed volunteers (age – 24.6±3.4 years, 14 female) participated in the study. First, in the SA baseline, the participants were required to rate the intensity of tactile electrical stimulation on a 0-7 Likert scale; the actual intensity of the stimuli was the same in all trials (2.5 times individual sensory threshold + 4 mA with 300V voltage). The stimulus was delivered to participants' right index finger as a result of a button press. The button press was either executed by the participants (Self condition) or by the non-embodied fake hand (Other condition). In 50% of the trials, self-produced stimulation was preceded by a TMS pulse (115% of rMT) over the SMA delivered 10 ms before participant's button press (Self+TMS condition).

Secondly, in the experimental condition that combined RHI and SA paradigms, after one minute of synchronous tactile stimulation, the embodied fake hand pressed the button to produce the same electrical stimulation as in the baseline (Embodiment condition). In 50% of the trials, the fake hand's movement was also preceded by a TMS pulse to the SMA (Embodiment+TMS condition). Participants rated stimuli intensity on the same 0-7 Likert scale. Mean ratings of stimuli intensity were compared between conditions within the baseline and within the RHI+SA paradigm.

Results

Intensity of the stimuli produced by the embodied fake hand was attenuated exactly as the intensity of self-produced stimuli (Self (3.87 ± 1.49) < Other (4.60 ± 1.39), $p < .01$; Embodiment (3.62 ± 1.60) < Other, $p < .01$). Furthermore, in both cases, SA was reduced by the single TMS pulse over SMA (Self < Self+TMS (4.36 ± 1.55), $p < .01$; Embodiment < Embodiment+TMS (3.81 ± 1.63), $p < .05$).

Discussion

Our results show that: 1) it is possible to create a condition of embodiment of action and motor intention; 2) single pulse TMS over the SMA decreases SA, and therefore, interferes with motor intention for both voluntary and embodied actions. This suggests that the sense of agency triggered by body ownership is actually embedded within the intention-programming system, and provides both behavioral and neural evidence that body ownership per se contributes to human conscious awareness of willed actions.

References

1. Burin, D., Pyasik, M., Salatino, A., & Pia, L. (2017). That's my hand! Therefore, that's my willed action: How body ownership acts upon conscious awareness of willed actions. *Cognition*, 166, 164–173.
2. Haggard, P., & Whitford, B. (2004). Supplementary motor area provides an efferent signal for sensory suppression. *Cognitive Brain Research*, 19(1), 52–58.

19. L'ILLUSIONE DELLO SPECCHIO NEI PAZIENTI CON EMIPRESI POST-ICTUS

Cristina Russo¹, Giuseppe Vallar^{1,2}, Nadia Bolognini^{1,2}

1. *Dipartimento di Psicologia e Milan Center for Neuroscience-NeuroMi, Università di Milano-Bicocca, Milano, Italia*

2. *Laboratorio di Neuropsicologia, IRCCS Istituto Auxologico, Milano, Italia*

Introduzione

L'illusione dello specchio (Mirror Box Illusion, MBI) è alla base della Mirror Box Therapy, tecnica riabilitativa introdotta per la cura del dolore da arto fantasma e declinata per il trattamento di deficit motori conseguenti a ictus cerebrale (Ramachandran & Altschuler 2009). Durante la terapia, i pazienti posizionano entrambi gli arti ai lati di uno specchio posto perpendicolare alla linea mediana, con l'arto affetto nascosto dietro, inaccessibile alla vista, e compiono movimenti osservando il riflesso dello specchio. In questo modo si genera l'illusione di guardare direttamente l'arto affetto muoversi, favorendo il recupero di sensazioni (illusorie) di movimento. La riabilitazione con MBI appare promettente, ma le evidenze non sono definitive e i meccanismi alla